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NEW WHEAT VARIETY "*FAREED-06*" FOR IRRIGATED AREAS OF PUNJAB, PAKISTAN

MANZOOR HUSSAIN, GHULAM HUSSAIN, LAL HUSSAIN AKHTAR[2], ALTAF HUSSAIN TARIQ, MUHAMMAD RAFIQ, MUHAMMAD ZAHID ASLAM, MUHAMMAD ASLAM, MUHAMMAD ARSHAD, SAEED AHMAD AND SHAHBAZ TALIB SAHI[1]

Regional Agricultural Research Institute (RARI), Bahawalpur, Pakistan
[1]Sub-campus University of Agriculture, Faisalabad at Depalpur, Okara, Pakistan
[2]Agricultural Research Station, Bahawalpur, Pakistan
E-mail: lhakhtar@yahoo.com

Abstract

"Fareed-06" is a high yielding and rust resistant variety of bread wheat with erect growth habit. It was released in the year 2006 for irrigated areas of Punjab. *Fareed-06* originated from a cross between two genotypes PTS/3/TOB/LFN// BB/4/BB/HD-832-5//ON, (a high yielding line received from CIMMYT, Mexico) and GV/ALD'S'/ /HPO'S'BR-3385-3B-1B-0B (a local line resistant to rust diseases) at Regional Agricultural Research Institute (RARI), Bahawalpur. F1 to F4 progenies of this cross were advanced by pedigree method. Resistance against rusts (Leaf rust = 5R to 20RMR and Yellow rust = 10MS, RRI value of 8 for both leaf and yellow rusts and ACI values of 0.6 & 7.4 for both leaf and yellow rusts) and high yield potential (6000 kg ha^{-1}) are the major attributes of *Fareed-06* that make it a superior variety for its target regions. *Fareed-06* is tolerant to wheat aphid and *Helicoverpa armigera* and responsive to fertilizer compared to the check varieties. The 1000-seed weight of this variety is 38-42 gm. Seed is amber in colour and contains 11.9-13.3% protein, 26.5% wet gluten, 9.5% dry gluten, 1.83% ash. Its flour yield is 68.4%. It has good *chapati* making quality. Plant type *of Fareed-06* is erect with plant height 75-90 cm and droopy flag leaves. Auricle colour is white. Ear shape and colour is tapering and red. Its straw is soft. It completes heading in 75-85 days and matures in 110-120 days. *Fareed-06* performs better in irrigated areas of Punjab when planted from Ist November to 15 December, keeping 125 kg ha^{-1} seed rate and 125-100-75 kg NPK ha^{-1} are applied. It can be concluded that *Fareed-06* is not only a high-yielder, possesses better quality traits and tolerant/resistant to all diseases and insect pests, but is also best suited in wheat-cotton-wheat rotation.

Introduction

Wheat (*Triticum aestivum* L.) is a chief source of food for most of the human population in the world (Khan *et al*., 2008). It is the most widely grown crop in the world. In Pakistan, wheat being the staple diet is the most important crop and cultivated on the largest acreages (8.303 million hectares during 2005-06) in almost every part of the country. It contributes 13.7% to the value added in agriculture and 3.0% to GDP (National Coordinated Wheat Programme, NARC, Islamabad). Pakistan falls in top ten wheat-producing countries of the world and ranks at No. 9 in terms area, at No. 5 in terms of yield per hectare and at No. 8 in terms of production.

Southern Punjab, although cotton zone, contributes about 44% of the total wheat production of the province. Due to long stay of cotton crop in the field, 80% wheat is being planted under late conditions. This situation necessitates the development of medium to late maturing wheat varieties that can be successfully grown after the harvest of cotton (Ahmad *et al*., 2005).

The existing wheat varieties such as Inqlab-91 and Bhakkar-2002 have become susceptible to rust diseases and need to be replaced with new varieties (Anonymous, 2004 & 2005). Successive release of rust resistant varieties in Pakistan has reduced losses caused by rust (Khan, 1987). With the introduction of rust resistant varieties, new rust races also develop due to mutation, therefore, the plant breeders and plant pathologists have to be vigilant of its dynamics. Therefore, wheat variety having the higher yield potential, disease and insect resistance and better adaptability is a dire need of the day because low seed yield is also attributed to non-availability of pure seed of improved varieties along with low inputs and poor management practices (Sarwar *et al*., 1993). Khan & Din (1999), Saleem *et al*., (2002), Tariq *et al*., (2003), Siddiqi *et al*., (2001 & 2003), Ahmad *et al*., (2002 a, b), Ahmad *et al*., (2005), Sarwar & Ahmad (2003) and Bakhsh *et al*., (2005) have reported that the yield per unit area may be increased substantially through the evolution of high yielding genotypes, bearing a good combination of all yield components and disease resistance.

The new wheat variety *Fareed-06* is suitable for normal and late planting in irrigated areas of Punjab and will help to achieve the self-sufficiency in wheat production, due to its commendable traits of early maturity and rapid grain filling capacity under adverse climatic and soil conditions. Development and evolution of the new variety *Fareed-06* is described herein.

Material and Methods

Fareed-06 was developed from a cross between two genotypes PTS/3/TOB/ LFN//BB/4/BB/HD-832-5//ON (a high yielding line received from CIMMYT, Mexico) and GV/ALD‘S’//HPO‘S’BR-3385-3B-1B-0B (a local line resistant to rust diseases) at Regional Agricultural Research Institute (RARI), Bahawalpur. The hybridization was carried out during 1994-95 as described by Alam (1994) and pedigree method of breeding was used to develop this variety. The hybrid population was evaluated for target traits and advanced to F_4 generation. A single row of 4 m length was planted with F_0 hybrid seed. The seeds were sown by single row drill at RARI, Bahawalpur under irrigated conditions. The F_1 seeds were harvested in the end of April. Planting was done in 30 cm wide rows. This bulk planting was continued upto F_4 generation with negative selection of undesirable diseased plants under natural infection conditions. The seed from selected plants were bulk harvested. A high yielding and rust resistant line was selected during 1998-99 in F_4 generation and was given the number 99B4012. This line was tested in replicated wheat yield trials for grain yield evaluation and disease reaction. These trials were conducted at Regional Agricultural Research Institute (RARI), Bahawalpur and Wheat Research Institute, Faisalabad. Planting of on-station trials was done in the first week of November. The testing was done in Micro and Macro Yield Trials before testing in National Uniform Yield Trials. All the yield trials were laid out in RCBD with 4 replications. The row to row was maintained at 30 cm. Planting was done with single row drill in 4 row plots of 5 m length. One to two (1-2) standard checks were included in every experiment for comparison. A series of replicated yield trials were conducted for two years (2003-2005) at RARI, Bahawalpur; Agronomic Research Station, Bahawalpur and Agronomic Research Institute, Faisalabad for its response to different sowing dates and various NPK combination in comparison with the check varieties Inqlab-91, Punjab-96, Bahawalpur-2000 and Uqab-2000 to ascertain its production technology. Disease reaction was separately recorded under artificial inoculation conditions every year. Test entries were planted in a single 2-meter long, 30 cm apart row. Two rows of *Morocco*,

which is universally susceptible to rusts, were planted around the test entries. In addition, a row of susceptible check (Morocco) was also planted after every entry. Artificial inoculations with a mixture of field collection/national bulk inoculums of known prevalent races/virulences of the rusts were carried out during the month of March. Initially inoculations of spreaders, 3-5 tillers in a row, were carried out by hypodermic syringe method using aqueous uredospore suspension to which 1-2 drops of Tween-20 were added to break the surface tension. Subsequently, all the material was sprayed 2-3 times by turbo-air sprayer using aqueous spore suspension with fortnightly intervals to obtain heavy rust development. The data were recorded on leaf and yellow rusts as percent infection on the plants according the modified Cobb's Scale (Peterson *et al*., 1948) during the first week of April. Coefficient of Infection (CI) was calculated by multiplying the response value with the intensity of infection in percent. Average coefficient of infection (ACI) was calculated from the sum of CI values of each entry divided by the number of locations. Relative resistance Index (RRI) was calculated according the formula of Hussain *et al*., (1999). The desirable RRI value for leaf and yellow rusts is 7 (Aslam, 1982; Mustafa *et al*., 2007) and acceptable value is 5 or 6 (Mustafa *et al*., 2007). *Fareed-06* was also evaluated for three years (2002-2005) in replicated yield trials at RARI, Bahawalpur and Entomological Research Institute, Faisalabad for its response to wheat aphid and *Helicoverpa armigera* in comparison with the check varieties Inqlab-91 and Uqab-2000. Finally, the selected line was evaluated in national uniform yield trials. This trial was conducted at forty locations in 2003-04 and at 72 locations in 2004-05. At all the locations, the experiment was planted in RCBD with 4 replications. Six rows per plot where Row x Row distance was 30 cm were planted with each entry. The sowing time and crop husbandry practices were different at all the locations. The replicated data of individual locations were averaged and converted to kg ha^{-1} for comparison (Mustafa *et al*., 2004, 2005 and 2007). The Physico-chemical properties were studies by National Coordinator Wheat, National Agricultural Research Centre, Islamabad and Director, Agronomic Research Institute, Faisalabad. The test was carried out in Food Technology and Research Laboratory according to standard procedures including 1000-seed weight, test weight, PSI (hardness), grain ash, grain protein (by NIR) and gluten content (Mustafa *et al*., 2007). The yield data were subjected to ANOVA by computer using MSTATC statistical package and the means were compared using DMR test (Steel & Torrie, 1980). Various steps involved in the development of *Fareed-06* are given in Table 1.

Results and Discussions

Fareed-06 was studied for grain yield in preliminary (A), regular (B) and advance (C) yield trials from 1999-2000 to 2001-2002. The data on grain yield recorded in these trials are presented in Table 2. These data shows that grain yield of *Fareed-06* ranged from 2521 to 5420 kg ha^{-1} as compared to Inqlab-91 for which yield ranged from 2104-5194 kg ha^{-1}. The new variety gave 4.4 to 19.8% higher yield than Inqlab-91 (Table 2). The differences were highly significant. Earlier released varieties although possessed relatively high yield potential but those appeared to be susceptible to rusts as revealed in the results reported by Anon. (2004, 2005). Consequently, these are being banned by the government for general cultivation to avoid epidemic of rust. Since the major emphasis was placed on incorporation of rust resistance in the target variety aimed for release in irrigated areas of Punjab, *Fareed-06* appeared to be a promising line with respect to this major trait wanted for wheat cultivation in rust prone areas.

Table 1. Various steps involved in the development of wheat variety *Fareed-06*.

Year	Generations/Trials	Remarks
1994-95	Parental lines were inter-crossed at RARI, Bahawalpur	F_0 hybrid seeds were harvested for plantation
1995-96	F_1 population was raised	F_1 hybrid seeds were harvested for plantation of F_2
1996-97	F_2 population was raised	F_2 hybrid seeds were harvested for plantation of F_3
1997-98	F_3 population was raised	F_3 hybrid seeds were harvested for plantation of F_4
1998-99	F_4 population was raised	Rust resistant and high yielding progeny was selected and given the number 99B4012 and was forwarded to wheat yield trials
1999-02	A, B, C Trials	These trials were conducted at RARI, Bahawalpur
2002-03	Micro Wheat Yield Trials	These trials were conducted at various locations in Punjab under coded numbers by Director, Wheat Research Institute, Faisalabad
2003-06	Macro Wheat Yield Trials	These trials were conducted at various locations in Punjab by Director, Agronomic Research Institute, Faisalabad
2002-05	Rust resistance studies	These studies were conducted at RARI, NARC and WRI, Faisalabad
2002-02	Entomological Trials	These trials were conducted at RARI and Entomological Research Institute, Faisalabad
2003-05	National Uniform Wheat Yield Trials (NUWYT)	These trials were conducted by National Coordinator Wheat, NARC, Islamabad throughout Pakistan
2003-05	Physico-chemical characters and chemical composition of seed of *Fareed-06*	The quality traits were studies by NARC, Islamabad and Director, Agronomic Research Institute, Faisalabad
2006	On the basis of its better performance, it was released for general cultivation in the name of *Fareed-06* by the Punjab Seed Council, Lahore	

Table 2. Grain yield performance of *Fareed-06* in on-station trials at RARI, Bahawalpur.

Trial	Year	Yield (kg ha^{-1})		LSD (0.05)	% ± over Inqlab-91
		Fareed-06	Inqlab-91		
A (Normal)	1999-00	5420	5194	661	+04.4
A (Late)	1999-00	4672	4230	401	+10.4
B (Late)	2000-01	4183	3794	382	+10.3
C (Normal)	2001-02	3917	3646	625	+07.4
C (Late)	2001-02	2521	2104	412	+19.8

Fareed-06 was tested in micro wheat yield trials which were conducted by Director, Wheat Research Institute, Faisalabad during 2002-03 at 15 locations (normal and late sets) in whole of the Punjab province, under coded numbers. On the basis of 8 location average, *Fareed-06* gave 5.3 and 11.4% higher yield as compared to Inqlab-91 and Uqab-2000 (checks) in normal set while it gave 12.7 and 11.4% higher yield as compared to Inqlab-91 and Uqab-2000 (checks), respectively, in late set on the basis of average of 9 locations (Tables 3 and 4).

Macro wheat yield trials were conducted by the Agronomists at Agronomic Research Stations, Karore (Layyah) and Khanewal; Director, Agronomic Research Institute, Faisalabad (9 trials) and Regional Agricultural Research Institute, Bahawalpur for two years (2003-04 and 2004-05) in late and normal sets. The results presented in Tables 5-6 revealed that the new variety gave 3.1 to 36.4% higher yield than the check varieties like Inqlab-91, 3.2 to 59.6% than Bhakkar-2002, 23.3% than Manthar-03 and 30.2% than AS-2002 at all locations on the basis of average of 15 trials.

Fareed-06 was tested in national testing system through National Uniform Yield Trial (NUYT) consecutively for two years (2003-04 and 2004-05) across the country. The location wise comparison of *Fareed-06* with check varieties for grain yield is given in Tables 7-9. The results revealed that *Fareed-06* gave 17.6% higher yield than check variety Inqlab-91 on the basis of 4 locations average during 2003-04 (Table 7). *Fareed-06* gave 9.0 to 13.5% higher than Inqlab-91 and Wahaq-2002, respectively, during 2004-05 on the basis of average of 14 locations (Table 8). *Fareed-06* produced 1.5, 8.0 and 9.8% higher yield than Inqlab-91, Wafaq-2002 and local check, respectively, during 2003-04 and 1.6 and 7.2% higher than local check and Wafaq-2002 during 2004-05 on the basis of average of trials conducted throughout Punjab under normal and late conditions (Table 9). The two years evaluation of *Fareed-06* over multiple locations confirmed the results of on-station studies where it was concluded that *Fareed-06* having better grain yield compared to already released varieties possesses high tolerance against rust diseases. It was also observed that with overall good performance, the new variety is well adapted to various climatic conditions of Punjab and Pakistan.

Fareed-06 was also tested for grain yield performance at Punjab Seed Corporation Farms, Khanewal during 2004-05 and 2005-06 in bigger blocks. Results given in Table 10 reveal that the new variety was the best performer in term of yield compared to the checks by producing 3.6 to 54.1% higher yield.

Table 3. Grain yield performance of *Fareed-06* in Micro Wheat Yield Trial (normal) during 2002-03.

Locations	Yield (kg ha^{-1})			
	Fareed-06	**Inqlab-91**	**Uqab-2000**	**LSD (0.05)**
HSS, Renala Khurd	2870	2824	2546	611
AZRI, Bhakkar	3056	2852	2852	1020
IATI, Sargodha	3204	3093	2944	671
Biotech, AARI, Faisalabad	5634	5500	4731	509
RARI, Bahawalpur	4028	3681	3958	563
CRSS, Haroonabad	4618	4444	3819	991
ARF, Rahim Yar Khan	5361	5361	4840	1036
ORS, Khanpur	4583	3924	4236	769
Average (8 locations)	4169	3959	3741	-
%± over checks	-	+5.3	+11.4	

Table 4. Grain yield performance of *Fareed-06* in Micro Wheat Yield Trial (late) during 2002-03.

Locations	Yield (kg ha^{-1})			
	Fareed-06	**Inqlab-91**	**Uqab-2000**	**LSD (0.05)**
MMRI, Sahiwal	3565	2870	2963	707
HSS, Renala Khurd	3287	3056	2731	450
SAH Farm, Wah Addan	3981	3241	2611	710
WRI, Faisalabad	4031	3858	3938	417
ARF, Vehari	3148	2778	3111	459
AZRI, Bhakkar	2111	1981	2000	560
RARI, Bahawalpur	3368	2917	3403	737
CRSS, Haroonabad	3090	2639	3056	306
U. A. Faisalabad	2815	2737	2567	377
Average (9 locations)	3266	2897	2931	-
%± over checks		+12.7	+11.4	

Several earlier workers like Khan & Din (1999), Saleem *et al*., (2002), Ahmad *et al*. (2002), Tariq *et al*., (2003), Siddiqi *et al*., (2001 & 2003), Ahmad *et al*., (2002a,b), Ahmad *et al*. (2005), Sarwar & Ahmad (2003) and Bakhsh *et al*., (2005) reported higher yield in new sesame, mungbean, chickpea, guar, wheat and cotton varieties than the checks.

Six trials were conducted at Regional Agricultural Research Institute, Bahawalpur, and Agronomic Research Station, Bahawalpur during the years, 2003-04, 2004-05 and 2005-06 to ascertain its package of production technology. The results are summarized in Tables 11-13 which show that *Fareed-06* performed better in irrigated areas of Punjab when planted from 1st November to 15 December, keeping 125 kg ha^{-1} seed rate, fertilizer @ 125-100-75 kg NPK ha^{-1} and 5-6 irrigations are applied. Similar results were reported by Siddiqi *et al*., (2003) and Ahmad *et al*., (2002a, b).

Table 5. Grain yield performance of *Fareed-06* in Macro Wheat Yield Trials during 2003-04 to 2005-06.

Varieties	Yield (kg ha^{-1})			% ± over checks
	Normal	Late	Combined	
at Agronomic Research Station, Karore, Layyah (2003-04) (2 trials)				
Fareed-06	4723	3205	3964	-
Inqlab-91	4042	2861	3452	15.0
Bhakkar-2002	4314	2959	3637	09.0
LSD (0.05)	272	143	-	-
at Agronomic Research Station, Khanewal (2004-05) (2 trials)				
Fareed-06	5417	2917	4167	-
Bhakkar-2002	4028	2083	3056	59.6
Inqlab-91	3472	1750	2611	36.4
LSD (0.05)	305	78	-	
at RARI, Bahawalpur (2005-06) (2 trials)				
Fareed-06	3942	3212	3577	
Uqab-2000	3380	3278	3329	07.4
Bhakar-2002	3321	2945	3133	14.2
Manthar-03	2937	2862	2900	23.3
Inqlab-91	2862	2726	2794	28.0
As-02	2986	2507	2747	30.2
LSD (0.05)		192	274	

Table 6. Grain yield performance of *Fareed-06* in Macro Wheat Yield Trials during 2005-06 (9 trials).

Varieties	Govt. farm (5-Sites)	Farmer field (4-Sites)	Average (9 Trials)	% ± over checks
Fareed-06	4078	4194	4136	
Inqlab-91(Check)	4127	3892	4010	3.1
Uqab-2000 (Check)	3976	4037	4007	3.2

Table 7. Grain yield performance of *Fareed-06* in National Uniform Wheat Yield Trials at various locations (2003-04).

Locations	Yield (kg ha^{-1})		
	Fareed-06	Inqlab-91	LSD (0.05)
ARF, Rahim Yar Khan	2749	2526	182
ORS, Khanpur	3534	3129	194
SSRI, Pindi Bhattian	3979	3178	127
NARC, Islamabad	4425	3650	516
Average (4 locations)	3671	3120	
% ± over checks	-	+17.6	

Source: Mustafa *et al.*, (2004)

Table 8. Grain yield performance of *Fareed-06* in National Uniform Wheat Yield Trials at various locations (2004-05).

Locations	Yield (kg ha^{-1})			
	Fareed-06	**Wafaq-2002**	**Inqlab-91**	**LSD (0.05)**
ORS, Khanpur	3802	3785	3385	298
RARI, BWP	4448	3976	3979	308
CRS, Bahawal Nagar	3967	2993	3655	356
P.S.C. KWL	2635	2052	2604	280
Farhatullah Khan, Khanewal	3167	2542	3135	294
Ghousahad D.G.Khan	4132	3378	3507	310
Roodawala M.Garh	4292	3300	3715	292
P.S.C F. Piplan	2771	2583	2438	365
Ch. 277 T. T. Jhang	2809	2576	2467	330
WRI, Faisalabad	4775	4413	4683	450
U.A, Faisalabad	4146	3798	4018	232
Wanadan Kasur	4646	3969	3969	347
S. F. I. Kasur	4531	4404	4165	404
H.F. Bhimber	3719	3669	3669	134
Average (14 locations)	3846	3388	3528	
% ± over checks	-	+13.5	+9.0	

Source: Mustafa *et al*., (2005)

Table 9. Grain yield performance of *Fareed-06* in National Uniform Wheat Yield Trials at various locations (Punjab basis).

Varieties	Normal	Late	Combined	% ± over checks
		2003-04		
Fareed-06	4184	3205	3695	
Inqlab-91	3920	3439	3639	1.5
Wafaq-2002	3781	3060	3421	8.0
Local Check	3738	2991	3365	9.8
		2004-05		
Fareed-06	3877	3365	3611	
Local Check	3916	3247	3554	1.6
Wafaq-2002	3636	3144	3367	7.2
LSD (0.05)	106	90	70	

Source: Mustafa *et al*., (2004 and 2005)

Table 10. Grain yield performance of *Fareed-06* at Punjab Seed Corporation Farms, Khanewal.

Varieties	Area (ha)	Yield (kg ha^{-1})	% ± over checks
		2003-04	
Fareed-06	0.91	4833	
Inqlab-91	0.91	4667	3.6
Bhakkar-2002	4.0	3522	37.2
Uqab-2000	0.91	4602	5.0
		2004-05	
Fareed-06	0.91	4622	
Inqlab-91	3.64	4168	10.9
Bhakhar-2002	2.73	4061	13.8
AS-2002	0.45	3058	51.1
Ufaq-2002	0.91	3000	54.1

Table 11. Grain yield performance of *Fareed-06* in sowing date trial at Regional Agricultural Research Institute, Bahawalpur.

Year	Varieties	Yield (kg ha^{-1})					
		Nov.1	Nov.15	Nov.30	Dec.15	Dec.30	Jan. 15
		D1	D2	D3	D4	D5	D6
2003-04	*Fareed-06*	5473	5507	3959	3341	3014	2660
	Inqlab-91	4750	3450	3705	2722	2500	1840
	Uqab-2000	4931	3736	3195	2750	2709	1938
LSD (0.05) for sowing date = 415, for varieties = 262, for interaction = 642							
2004-05	*Fareed-06*	3518	4833	4056	3333	2400	2456
	Inqlab-91	5037	4444	3866	3333	1713	945
	Uqab-2000	5814	4811	4077	3666	2045	1333
LSD (0.05) for sowing date = 188, for varieties = 196, for interaction = 479							

Table 12. Grain yield performance of *Fareed-06* in sowing date trial at Agronomic Research Station, Bahawalpur.

Varieties	Yield (kg ha^{-1})				
	Nov. 1	Nov. 15	Nov. 30	Dec. 15	Dec. 30
2004-05					
Fareed-06	5037	5760	4047	2903	2019
Inqlab-91	4743	5532	4177	2780	2203
Punjab-96	4717	5390	4064	2917	2230
LSD (0.05) for sowing dates = 28.83, for strains = 60.98, for interaction = 136.40					
2005-06					
Fareed-06	5469	5990	4948	3385	2604
Bhakkar-2002	5208	5469	4948	3385	3125

Table 13. Grain yield performance of *Fareed-06* in Fertilizer trial at RARI, Bahawalpur.

NPK (kg ha^{-1})	2003-04		2004-05	
	Fareed-06	Bahawalpur-2000	*Fareed-06*	Bahawalpur-2000
0-0-0	1720	1628	2100	1893
75-50-25	2985	2670	3390	3193
125-75-50	3802	2898	4484	3326
175-100-75	4000	3448	4663	3680

Table 14. Disease reaction of *Fareed-06* at RARI, Bahawalpur and NARC, Islamabad.

Institutes	Years	*Fareed-06*		*Morocco*	
		Leaf rust	Yellow rust	Leaf rust	Yellow rust
RARI, Bahawalpur	2002-03	10R	-	80S	-
	2003-04	5R	-	70S	-
	2004-05	10MR	1-MS	90S	70S
	2005-06	20RMR	10MRMS	100S	60S
NARC, Islamabad	2002-03	-	20RMR	-	50S
	2003-04	10MSS	10MSS	90S	90S
	2004-05	5MRMS	10MRMS	80S	90S
	2005-06	-	0	-	80S

0, R, MR. RMR, MRMS and MS denote resistant reactions while S denotes susceptible reaction (Anonymous, 2004 and 2005; Hussain *et al*., 1999)

Table 15. Disease reaction of *Fareed-06* at CDRP, NARC, Islamabad in NUWYT Nursery during 2003-04.

Varieties	LR		YR	
	T.R	RRI	T.R	RRI
Fareed-06	10MSS	8	10MSS	8
Morocco (check)	90S	0	90S	0

LR=leaf Rust, TR = Terminal Reaction, LR = Leaf rust, YR=Yellow rust,
RRI= Relative resistance index [above 5 is acceptable (means the variety is resistant to rusts)] Aslam (1982)
Source: Anon., 2004

Table 16. Disease reaction of *Fareed-06* in NUWYT during 2003-05.

Varieties	RRI (Relative Resistance Index)			
	2003-04		2004-05	
	Leaf rust	Yellow rust	Leaf rust	Yellow rust
Fareed-06	8	8	8	5
	ACI (2004-05)			
	Leaf Rust		Yellow rust	
	0.6		7.4	

Source: Mustafa *et al*., (2004 and 2005), (Anon., 2005), Aslam (1982)

The response of the variety *Fareed-06* to various foliar diseases was studied at (i) Crop Diseases Research Programme, NARC, Islamabad, (ii) Wheat Research Institute, Faisalabad, and (iii) Regional Agricultural Research Institute, Bahawalpur. The disease score *of Fareed-06* and the check varieties recorded from 2002-03 to 2005-06 is presented in Tables 14-16. The comparison *of Fareed-06* with released varieties showed that the rust score of *Fareed-06* varied from 5R to 10MSS for leaf rust and 10MRMS to 10MSS for yellow rust as compared to 70S to 100S for leaf rust and 50S to 90S for yellow rust of the check variety i.e., Morocco (Tables 14 & 15). *Fareed-06* had RRI value of 8 is above desirable limit. The ACI values of *Fareed-06* also render it rust resistant variety (Table 16). Resistance against leaf and yellow rust makes *Fareed-06* a better option for rust prone areas. Leaf and yellow rusts of wheat, beside yield reduction, damages the quality of grain as well. Therefore, the grains obtained from susceptible varieties grown under diseased conditions are of inferior quality, whereas, the resistant varieties produces better yield and grains of better quality. This phenomenon was recorded in the case of *Fareed-06* as well when grown in disease condition. Ahmad *et al*., (2002 a, b & 2005) and Siddiqi *et al*., (2003) reported new varieties of wheat to be more resistant to rust diseases compared to checks.

The response of the variety *Fareed-06* to various insect pests was studied at Entomological Research Institute, Faisalabad (2003-04 and 2004-05) and Regional Agricultural Research Institute, Bahawalpur (2002-03). The perusal of the data presented in Table 17 shows that the *Fareed-06* had less attack of wheat aphid and *Helicoverpa armigera* as compared to the check varieties Inqlab-91 and Uqab-2000 both at Bahawalpur and Faisalabad. Ahmad *et al*. (2002a, b & 2005) and Siddiqi *et al*., (2001) reported similar results for new wheat varieties.

Table 17. Response of *Fareed-06* to aphid and *Helicoverpa armigera* (Ha) during 2003-04 and 2004-05.

Institutes	Years	*Fareed-06*		Inqlab-91		Uqab-2000	
		Aphid	Ha	Aphid	Ha	Aphid	Ha
Entomological Research Institute, Faisalabad	2002-03	1.24a	-	3.06c	-	-	-
RARI, Bahawalpur	2003-04	10.0	0.27	16.0	0.33	20.0	0.47
	2004-05	3.19	1.06	7.04	0.76	3.97	0.51

Table 18. Physico-chemical characters and chemical composition of seed of *Fareed-06* in NUWYT.

Varieties	1000- grain wt. (g)	Test wt (Kg/HL)	PSI	Grain ash (%)	Grain protein (% d.b)	Gluten consistency	Wet. gluten (%)	Dry gluten (%)	SDS value (cc)
2003-04									
Fareed-06	36.75	78.3	34	1.83	13.29	S	26.52	9.56	27.2
Inqlab-91	41.56	80.1	37	1.48	15.40	MS	35.30	11.71	30.0
Wafaq-2002	37.12	78.4	36	1.36	10.48	S	17.47	7.0	20.0
2004-05									
Fareed-06	39.5	76.9	31	1.675	13.16	M.S.	27.72	8.44	18.0
Wafaq-2002	41.5	72.4	46	1.194	8.9	MS-W	29.97	8.91	13.7

Source: Mustafa *et al*., (2004 and 2005)

Table 19. Physico-chemical characters and chemical composition of *Fareed-06* during 2004-05 at Agronomic Research Institute Faisalabad.

Varieties	1000- grain weight (g)	Test weight (kg/HL)	Protein (%)	Flour yield (%)	Chapatti quality	Bread quality score points/100
Fareed-06	39.00	80.10	11.89	68.41	Good	60.00
Inqlab-91	42.80	79.70	11.00	69.89	F. Good	68.50

Seed quality is an important parameter that determines the acceptability of a commodity among the consumers (Bhatty, 1988). The comparison of quality parameters showed that seed of *Fareed-06* contains 11.9-13.3% protein, 26.5% wet gluten, 9.5% dry gluten and 1.83% ash. Its flour yield is 68.4%. It has good chapati making quality. The quality traits recorded by National Agricultural Research Centre, Islamabad, and Director, Agronomic Research Institute, Faisalabad are given in Tables 18-19, which reveals that the new variety is better than the existing checks. Gluten consistency of the variety is strong to medium strong, while gluten %age of the variety is also acceptable. Mustafa *et al*., (2004 & 2005) reported similar results for new wheat varieties.

The plant of Fareed-06 is erect. At boot stage the plant colour is dark green. It has 135 productive tillers at maturity. Plant height is 75-90 cm. Stem colour is red and diameter is 4cm with upper internodal length of 33cm. Number of nodes from ground level are 4. Flag leaf width and length are 1.5 and 29cm, respectively. Auricle hairiness is sparse with week anthocyanin. Its straw is soft. It completes heading in 75-85 days and matures in 110-120 days. It is lodging and disease (rusts) resistant. The ear emerges 75-85 days after sowing. Ear colour is red at maturity with a width and length of 0.8-1.0 and 7-12 cm, respectively. Its size is medium and shape is tapering. It is dense and shattering resistant. Fareed-06 is awned variety. Awn's length is 6-8 cm and colour is light. Awn habit is horizontal. Anther colour is yellow. *Fareed-06* has long seed size with amber colour. The seeds are elongate with a width and length of 3 and 5-7 mm, respectively. Seed thickness is 1.5mm. Seed germ size is longer with intermediate seed groove. Seed is hard with rough surface. Number of seeds per spike varies from 50 to 70. Its 1000-seed weight is 38-42 grams.

Conclusion

Fareed-06 (99B4012) is not only a high-yielder, possesses better quality traits and tolerant/resistant to all diseases and insect pests, but is also best suited in wheat-cotton-wheat rotation. Due to its better adaptability, it has the potential to replace the previously approved wheat-varieties. This variety was approved and released by Punjab Seed Council, Lahore, during its meeting held during 2006 under the Chairmanship of Minister for Agriculture, Government of the Punjab, for general cultivation in irrigated areas of Punjab for normal and late sowing under the name of "*Fareed-06*".

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